

PROJECT NUMBER: 1720
PROJECT TITLE: Analytical Microscopy
PROJECT LEADER: V. L. Baliga
PERIOD COVERED: September, 1988

I. LOW SIDESTREAM CIGARETTE PAPERS (BALIGA, HENRY)

- A. Objective: Examine the structure of cigarette papers and paper additives in support of the low sidestream project.
- B. Results: Five handsheets were made for the low sidestream project and were examined for particle distribution on and within the paper. Sheets made with Multiflex MM CaCO_3 contained large clumps of Ca-containing filler material with more of the clumps on the wire side of the paper. The Multiflex MM CaCO_3 particles did not coat the fibers. Fibers from handsheets made with Omega fine CaCO_3 also were not coated with the additive. In contrast to the handsheets made with the Multiflex MM CaCO_3 , the handsheet made with Omega fine CaCO_3 did not have large clumps of the additive. Two of the Multiflex MM containing handsheets contained carbon, one at 0.5% by wt. and one at 1% by wt. The carbon particles were evenly distributed across the sheet in both samples. As measured by image analysis, the majority of carbon particles in the 0.5% carbon sheet was less than 5 μm in diameter while the majority of particles in the sheet with 1% carbon was between 11 μm to 25 μm in diameter. There may have been some sieving action occurring during the production of the two different carbon containing sheets to explain the difference in carbon size¹.

C. References:

Baliga, V., P.M. Notebook #8412, pp. 149, 153-155.

II. SUPPORT TO OPERATIONS AND R&D (BALIGA, SANDERS, HENRY)

- A. Objective: Provide analytical support to Operations and R&D.
- B. Results:

Characterization of Cork-Tipped and Pearl-Tipped Cartier Cigarettes: Tipping paper and rod paper from two different Cartier cigarettes were examined for their structure and composition. One cigarette used a pearl tipping paper and the other used a cork tipping paper. The outer surface of the pearl tipping paper contained mica and Ti-containing particles and a few glass-like fibers. The inside surface of the tipping paper was made of softwood fibers with no observable additives. The tipping paper contained dilution holes scattered randomly within a 6mm wide area around the filter. The total area of dilution holes was 0.73 mm^2 with a mean hole area of 0.0014 mm^2 .

The outer surface of the cork tipping paper was coated with a layer of rectangular rods 0.3 μm by 0.8 μm . Beam damage caused the particles to melt and fuse together, which suggested that they

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were made of a waxy substance. Glass-like fibers were found on the outer surface. Dilution holes were within a 2mm wide area around the filter and had a total area of dilution holes at 0.52 mm² and a mean hole area of 0.002 mm².

The rod paper appeared to be similar for both cigarettes. The paper contained flax fibers and standard CaCO₃ as well as a smaller size of CaCO₃ at 0.3 μm to 0.03 μm in diameter. No other additives were detected using EDS. However, by using light microscopy, dark specks could be seen scattered throughout the paper¹.

Examination of Metal Fragments from ART Vessel and Basket:

Scrapings from the wall of the ART vessel and from the basket used in the ART vessel were found to contain metal fragments and stem pieces. The main elements found in the metal scrapings from the basket were Fe, Cr, Pb, and Cu. There were two distinctive shapes of metal fragments, one was a round glob shape while the other was a rectangular shape. These fragments were not homogeneous. They contained several discrete areas of different metals.

Elements found in the fragments from the ART vessel wall were Ni, Fe, K, S, and Si. Again the fragments were not homogeneous.

Stem pieces associated with the metal fragments contained K, Ca and Cl as well as Fe, Cu, Si, Cr, Ni, and Zn ².

Examination of U-Shaped Metal Part from ART Vessel: Striations were seen throughout the length of the metal. Fractures were more prevalent at the edge of the metal than toward the center of the piece. There appeared to be an outer layer of metal that coated the part. A roughness at the rounded end of the metal part appeared to be created by the separation of this coating layer from the underlying layer. There also were more fractures on the curved end of the piece³.

Examination of Nicotine Bitartrate Dihydrate: Three samples of synthesized nicotine bitartrate dihydrate were examined to determine their size and structure. Two samples were sieved and one was not. All samples contained thin wafer-like structures of different sizes. All three samples contained particles in the size range of 1 μm to 44 μm in length⁴.

C. References:

1. Baliga, V., Sanders, K., and Henry, B., "Structural and Elemental Characterization of Regular and Thin Cartier Cigarettes," Memo to B. Handy, August 31, 1988.
2. Baliga, V., Sanders, K., "Metal Fragments from ART Baskets and ART Vessel Walls," Memo to D. Watson, September 14, 1988.
3. Sanders, K., "Analytical Microscopy Result Form," to B. Laroy, September 9, 1988.
4. Sanders, K., "Analytical Microscopy Result Form," to S. Haut, September 20, 1988.

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